

# Advances in hernia surgery

Citation for published version (APA):

Mommers, E. H. H. (2018). *Advances in hernia surgery: preoperative, intraoperative, and postoperative developments in abdominal wall surgery*. [Doctoral Thesis, Maastricht University]. Datawyse / Universitaire Pers Maastricht. <https://doi.org/10.26481/dis.20180329em>

**Document status and date:**

Published: 01/01/2018

**DOI:**

[10.26481/dis.20180329em](https://doi.org/10.26481/dis.20180329em)

**Document Version:**

Publisher's PDF, also known as Version of record

**Please check the document version of this publication:**

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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Why haven't we solved one of the most frequent complications of abdominal surgery?

Any 'number' surrounding abdominal wall hernias is impressive, whether it is the three million repairs performed annually throughout the world, the eleven to thirty-nine percent recurrence rate after repair, the six-billion-dollar expendable market surrounding surgical intervention or the ten percent emergency procedures necessary to prevent serious illness or even death. It are these disturbing numbers that justify scientific research in this important field. A hernia consists of three defined anatomical structures, the hernia defect, hernia sac, and hernia contents. Managing any type of hernia consists of three equally important phases, the preoperative phase, intraoperative phase, and postoperative phase. The complexity of the hernia, combined with the patient characteristics will increase or decrease the complexity of each management phase. 'Standard' hernias, such as a small umbilical hernia, will require less preoperative planning compared to a large incisional hernia with loss-of-domain. The origin of this thesis was born out of necessity, as managing complex hernias requires not only a clinical performance, though also an academic investment to evaluate and reflect the obtained results. This thesis was not aimed at developing any type of commercial product. On the contrary, it is a call for less commercial products, a testament to previous work, a chance for reflection, and an exploration of recent advances in ventral hernia repair.

## TARGET POPULATION

The academic field of hernia repair consists of several sub domains, classified according to the anatomical location of the hernia. Inguinal hernias are most common and make up 75% of the field, followed by femoral hernias, umbilical hernias, epigastric hernias, and incisional hernias in decreasing order of incidence. Inguinal hernias frequently occur in elder males, epigastric hernias have no gender preponderance, and incisional hernias are essentially a complication from surgery, though age and male gender are known risk factors.

The focus of this thesis is on ventral hernias, a combination of primary and incisional hernias, including epigastric, umbilical, and suprapubic, hernias form approximately 10-15% of all hernias. Hence, the socioeconomic relevance of this thesis lies in providing the best possible care for these patients. This includes any preoperative, intraoperative, and postoperative decisions made regarding the treatment of ventral hernias.

## RELEVANT OUTCOMES OF THIS THESIS

Despite any scientific gains resulting from this thesis, it is important to keep the patients' perspective in mind. Far too often doctors are concerned with the type of mesh, or the type surgical technique suitable for treating a hernia. Although these are valid considerations, patients are usually not very interested in different types of surgical mesh, nor are they interested in the technical approach. They want to know how long it takes before the pain goes away, if there is a change of chronic pain, what the cosmetic outcome will be, and when they can go back to work. These are examples of patient reported outcome measures. One would expect that this type of outcome is used frequently in scientific research, yet the opposite is true. A 2014 high-impact review states that between 2008 and 2012 only 16% of high-impact articles in general surgery reported at least one patient reported outcome (PRO). Only ten of these articles concerned hernia repair. This thesis includes a publication with a new type of PRO-questionnaire specifically designed for measuring PROs in a hernia population.

Despite the surgeon's best efforts, complications are inevitable. Though the risk of postoperative complications is not equal for all patients. This thesis describes a new diagnostic device (the electronic nose) that can be used to identify patients that are at high risk for a recurrence of their ventral hernia. Although the evidence is still low grade and more research is needed to determine the translatability to the clinic and confirm the accuracy of the proof-of-concept study, the idea of implementing the electronic nose in the field of hernia repair is promising. The device measures volatile organic compounds in exhaled air to determine if patients are at risk for a certain disease. The proof-of-concept study included in this thesis shows that the eNose can accurately differentiate recurrent hernia patients from healthy controls, as well as aortic aneurysm patients from healthy controls.

Alongside the groundwork for eNose diagnostics and hernia volume as a risk factor for pulmonary complications, this thesis includes three detailed technique descriptions, two regarding ventral hernia repair and one regarding rectus diastasis. The latter may not be a true ventral hernia, though patients are frequently referred to the surgery outpatient clinic for treatment. This thesis provides some recommendations for treating rectus diastasis and has found that physiotherapy for rectus diastasis is not an evidence-based therapy at this moment.

## INNOVATION & FUTURE

Hernia repair is slowly moving towards centralisation, in which the straightforward cases are treated in regular clinics and complex cases are centralised in specialised clinics. Though currently there is a lack of standardisation to facilitate the selection of straightforward repairs and define complex cases. The results of this thesis, with the

description of several surgical techniques such as the Endoscopically assisted Component Separation Technique (ECST), the modified Chevrel technique for complex hernia repair, and the identification of new risk factors (Hernia volume) and innovative diagnostic tools (eNose) can help in the specialisation process. Dedicated hernia repair centers must have several surgical approaches readily available for treating complex hernias, including standard and 'go-to' techniques. One of the most frequently used techniques for open complex hernia repairs is the Rives-Stoppa approach with a sublay mesh. Though experienced centers must have techniques, such as ECST and modified Chevrel techniques, in their repertoire in case the standard technique does not allow midline closure. The primary goal of ventral hernia repair should be midline closure with mesh reinforcement. Bridging repairs should only be used in case midline closure is not possible. Recent studies indicate that laparoscopic repairs should also attempt to close the hernia defect to prevent seroma formation and other adverse surgical site occurrences.

During the following years the most important development in the field of ventral hernia repair will not be a surgical technique such as Botox, or a commercial development such as a new type of mesh. Instead, the most important innovation will be the development and implementation of evidence and expert opinion-based guidelines for ventral hernia repair. Implementing guidelines will facilitate the division of 'standard' and 'complex' cases and aid the development of specialised clinics. Moreover, standardisation in the field of ventral hernia repair will increase interstudy comparability, as the multitude of different meshes, techniques, and fixation methods is currently reducing the translatability and comparability of scientific research. Unifying the field of hernia research can drastically increase the quality of the scientific output of the hernia community, as well as provide better guidance to the commercial industry surrounding ventral hernia repair.